

KAPITSA, P. L.

"The Change of Electrical Conductivity in Strong Magnetic Fields. I. Experimental Results," Proceedings of the Royal Society (London), Series A, Vol. 123, No. 791, pp. 292-341, 1929

". . . II. The Analysis and the Interpretation of the Experimental Results,"
ibid., pp. 342-372, 1929

KAPITSA, P. L.

"Reply to James H. Bartlett Jr.'s 'A Property of Superconducting Metals,'" *Nature*,
Vol. 123, No.3110, pp 870-871, 1929

The Cavendish Laboratory, Magnetic Laboratory, Cambridge

KAPITSA, P. L.

"Magnetostriction and the Phenomenon of the Curie Point," Proceedings of the Royal Society (London), Series A, Vol. 124, No. 793, pp. 1-15, 1929

KAPITSA, P. L.

"Magnetostriktion of Diamagnetic Substances in Strong Magnetic Fields," Nature,
Vol. 124, No. 3115, p. 53, 1929

The Cavendish Laboratory, Magnetic Laboratory, Cambridge

KAPITSA, P. L.

"Change of Resistance of Au Crystals at Very Low Temperatures in a Magnetic Field,"
Proceedings of the Royal Society (London), Series A, Vol. 126, No.803, pp. 685-695, 1930

KAPITSA, P. L. and COCKROFT, J. D.

"Hydrogen Liquefaction Plant at the Royal Society Mond Laboratory," *Nature*,
Vol. 129, No.3250, pp. 224-226, 1932

Royal Society Mond Laboratory, Cambridge

KAPITSA, P. L.

"Liquefaction of Helium by an Adiabatic Method Without Precooling with Liquid Hydrogen," *Nature*, Vol. 133, No. 3367, pp. 708-709, 1934

Royal Society Mond Laboratory

KAPITSA, P. L.

"The Liquefaction of Helium by the Adiabatic Method," Proceedings of the Royal Society (London), Series A, Vol. 147, No. 860, pp. 189-211, 1934

Royal Society Mond Laboratory

1.1. ANY NEW SERIES										PROCESSES AND PROPERTIES INDEX									
<div style="position: absolute; top: 10px; left: 10px; font-size: 2em; font-weight: bold;">AC</div> <div style="position: absolute; top: 10px; right: 10px; font-size: 2em; font-weight: bold;">a-1</div> <div style="position: absolute; top: 200px; left: 200px;"> <p>Zeeman effect and Paschen-Back effect in powerful magnetic fields. P. L. KAPTELA, P. G. MYRNEKOV, and H. I. LAURIMAN (Dok. Akad. Sci. U.S.S.R., 1958, Ser. Phys., 225--227).—The magnetic separation of lines belonging to the principal sharp series and the subordinate series of Cu, Zn, Cd, (II), and Mg was investigated, using a field of 257 k-gauss. Fields calc. from different lines on the same spectrogram give an equal field val. agreeing with independent electromagnetic observations. The anomaly formerly observed in the Zeeman effect with Zn was due to confusion of Zn and Cu lines. The initial stage of the Paschen-Back effect in the Zn triplet $^2P^{\circ}$—2S was observed in a field of ~250 k-gauss. The effect was studied in the Cd doublet 1S—2P (λ 3128 Å.) up to 250 k-gauss, the observed splitting agreeing well with the calc. val.</p> </div>										<div style="position: absolute; top: 10px; right: 10px; font-size: 0.8em;"> 2-27 17E, 1-12 </div>									
ASD-36A METALLURGICAL LITERATURE CLASSIFICATION																			
1.1. ANY NEW SERIES										PROCESSES AND PROPERTIES INDEX									
1.1. ANY NEW SERIES										PROCESSES AND PROPERTIES INDEX									

[illegible]

SA	<p>1806. Influence of Friction Forces on the Stability of High Speed Rotors. P. Kapitza. <i>J. of Physics, U.S.S.R.</i> 1:1 pp 20-29, 1939.</p> <p>The theory of the transition through the critical speed for high speed rotors is discussed. It is shown that this transition can be accomplished in the actual machines only if there is damping of the lateral vibrations of the shaft. It is suggested that in the existing machines the damping of the rot is due to the oil layer in the bearings. Calculations from actual examples support this assumption. The theory of the transition through the critical velocity for flexible shafts is given for cases when the transition through the critical point is attained by means of limiting rings. It is shown that the friction caused by the surrounding medium of the rotor has an important influence on the stability of the rotor. This frictional force necessarily induces lateral instability, and the axis follows a trajectory of the form of a logarithmic spiral with rotational frequency equal to that of the critical speed. The calculations show that in the presence of a damper complete stability can be obtained. Experimental data support the calculations put forward. By the introduction of a damper for the lateral vibrations, not only great stability is attained, but the transition through the critical speed is made easy; the rotor acquires immunity from outside shocks and the turbine no longer requires to be fixed to a rigid foundation. The author suggests that by the introduction of "ordered dampings" (that is, a damper designed according to the theory put forward) it is possible to obtain such stability of the rotor that the clearance between the rotating parts and the casing can be made very small, thus raising the efficiency of a number of fast rotating machines.</p>	B 69
ASD-5LA METALLURGICAL LITERATURE CLASSIFICATION	AUTHOR.	6-2-39-2. 1939
FROM: 570-21174	FROM: 50414	COLLECT: 600 151

Inst. for Physical Problems, Moscow

PROCESSED AND PROPERTY NOTED

Expansion turbine producing low temperatures applied to air liquefaction. P. L. Kapota. *J. Tech. Phys.* (U. S. S. R.) 6, 99-123 (1939).--Air is liquefied in the new expansion turbine at low pressures (4-5 atm.) in 30 min. One kg. of liquid air requires 1.7 kw.-hrs. A full description of the app. and its theory are given. Also in *J. Phys.* (U. S. S. R.) 1, No. 1, 7-29 (1939) (in English). J. J. H.

AVO 55.4 METALLURGICAL LITERATURE CLASSIFICATION

KAPITSA, P. L.
co

Apparatus for preparation of liquid air. P. Kapitsa.
Nesvois Trubnits 1939, No. 11-12, 40-3. Construction
details. A. A. Purgorny

ASB-51A METALLURGICAL LITERATURE CLASSIFICATION

1134-03-179

1134-03-179

KAPITSA, P. L.

"A Compressed-Gas Driven Turbomachine for Producing Low Temperatures and Its Application in Liquefying Air," 1939

KAPITZA, P.

"Expansion turbine producing low temperatures applies to air liquefaction."

J. Physics USSR 1939, 1, 7-28

The theory of the production of low temp. by means of the expansion turbine and its use for the low-pressure liquefaction of air is developed. An experimental turbine with an efficiency of 83% is described. A plant for the liquefaction of air with cooling by an expansion turbine is described. The working pressure is 5-6 atm., output 30 kg. of liquid air per hr., starting time 18-20 min., and power consumption 1.3 kw.-hr./kg. It is unnecessary to free the air from CO_2 and H_2O vapour.

KAPITSA, P. L.

"Problems of Liquid Air," *Planovoye Khoz.*, 16, No.2, pp. 73-80, 1939

1ST AND 2ND COPIES										3RD AND 4TH COPIES									
PROCESSING AND PROPERTY INDEX																			
54										A 53 9 7									
3000										532.13 : 532.63 : 536.222 : 536.483									
<p>Flow transfer and superfluidity of helium II. KAPITZA, P. L. <i>J. Phys., U.S.S.R.</i>, 5, 1, pp. 50-60, 1941.—It is shown that, when He is forced to flow under pressure through a slit, a temperature difference is produced up at the pressure. The thermodynamic reversibility of this thermo-hydrodynamic phenomenon in He II is confirmed, and it is suggested that the phenomenon provides a powerful method of attaining very low temperatures. Work in this direction has commenced, and, using a specially constructed pump to force liquid He through a porous plug, a temperature drop of 0.4 deg. K. has been obtained. It is thought that, unless unforeseen changes occur in the properties of He II, the approach to abs. zero should only be limited by the technical difficulties of developing the method.</p>																			
See Abstr. 3043										532.13 : 536.76 : 532.62									
ASS-5LA METALLURGICAL LITERATURE CLASSIFICATION																			
10000 117 000 001										10000 00100									
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<p>ca</p>		<p>2</p>	
<p>Investigation of the mechanism of heat conduction in helium II. E. A. Krause, <i>J. Appl. Theoret. Phys.</i> (U. S. S. R.) 11, 1-31; <i>J. Phys.</i> (U. S. S. R.) 4, 181-190 (1941) (in Russian). Expts. are described which show that the abnormally high apparent thermal cond. of He II is to be ascribed not to supercond. at lower temps. but rather to convection currents (made possible by the high fluidity of He II). Heat cond. was measured in capillary tubes; the temp. at the ends of the tubes were recorded with an accuracy of $\pm 0.001^\circ$. The max. heat cond. occurs at 1.9°K. The heat cond. is greater the smaller the capillary tube, and is decreased by setting the fluid in motion and thus disturbing the convection currents. In order to account for the magnitude of the effect it is assumed that the surface layer of He II has a much higher heat capacity than the body of the fluid. F. H. Rathmann</p>			
<p>ASB-ELA METALLURGICAL LITERATURE CLASSIFICATION</p>		<p>SCHEMATIC</p>	
<p>SCHEMATIC</p>		<p>SCHEMATIC</p>	

KAPITSKA, P. I. Academician

Mem., Dept. Physico-Mathematical Sci.,
Acad. Sci. (1944)

"Fundamental Problems in the field of
Mathematics and Science," Vest. Ak.
Nauk, SSSR, No. 11-12, 1944

●-5205019

KAPITSA, P. L., SEMENENKO, N. A. and BARDIN, I. P.

"Use of Oxygen in the Melting of Steel in Open Hearth Furnaces," Kislored,
3, No. 1, pp 12-14, 1946

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751. P. L. Kapitza, "Theoretical and empirical expressions for heat transfer in two-dimensional turbulent flow" (in English), U. S. Acad. Sci. USSR, Mar. 10, 1947, vol. 55, no. 7, pp. 501-509.

Equations for heat-transfer correlation based on heat transfer-velocity transfer analogy are reviewed. The equations, derived by Reynolds, Prandtl and Taylor, and von Karman, are all based on the assumed existence of combinations of three important and distinct regions—purely laminar layer, transition region, and turbulent region. In each region different laws of transfer apply.

The author writes the heat-transfer and friction equations in terms of a mixing length

$$Q = -(k + c\mu)\partial T/\partial y \quad (19)$$

$$\tau = -(a + m)\partial U/\partial y \quad (20)$$

where the mixing factor ∂ denotes their averaged product of the fluctuations of velocity u perpendicular to the wall and the mixing length l ; Q is rate of heat transfer per unit area, τ shear stress, k thermal conductivity, μ coefficient of viscosity, c specific heat, ρ density, T temperature, U stream velocity, and y distance perpendicular to the wall.

There being no experimental evidence of clearly defined boundaries between the laminar, transition, and turbulent regions, the author suggests that ∂ be expressed as a single continuous function of y . Such a function should make the velocity profile satisfy the following three conditions: (1) At the wall

$$\left. \frac{\partial U}{\partial y} \right|_{y=0} = \frac{U_*^2}{\nu} \quad (19a)$$

where the friction velocity U_* is determined from the shear stress at the wall $\tau_0 = \rho U_*^2$, and ν is the kinematic viscosity. (2) In the region very near the wall

$$\frac{\partial U}{\partial y} = \frac{U_*^2}{\nu} f\left(\frac{U_* y}{\nu}\right) \quad (21)$$

as suggested by Prandtl and confirmed by Nikuradse. (3) At a distance from the wall where U is appreciable, a "power law" variation may be assumed

$$\frac{U}{U_*} \sim \left(\frac{U_* y}{\nu}\right)^{1/4} \quad (22)$$

The author suggests the following possible form of the function which would satisfy the foregoing three conditions

Basic

X

$$\alpha = \frac{U^2}{1 + B \left(\frac{U}{U_0} \right)^{1-n}} \quad (22)$$

where B , C , n are constants.

Combining Equations (12), (13), and (22) with the Blasius expression for friction factor γ in terms of Reynolds number Re

$$\gamma = 0.0791 Re^{-0.25} \quad (23)$$

the author arrives at the heat-transfer correlation equation

$$\frac{\alpha}{G} = 0.0096 Re^{-0.25} Pr^{-0.4} \quad (24)$$

where α is film coefficient of heat transfer, G is mass velocity, and Pr is Prandtl number. This equation is quite similar to the generally accepted empirical correlation equation. The main assumption underlying it seems to be the mixture-factor expression, Equation (22), whose justification may require a more thorough experimental investigation of heat transfer and velocity phenomena close to the wall. Warren M. Rohsenow, USA

<p>332.517 - 82</p> <p>Under flow of this type of a viscous fluid. I. Free flow. Kiselev, V. L. <i>J. Exp. Theor. Phys.</i> 30 3-10 (Jan. 1960) in Russian. - The paper deals with the flow of this type of a viscous liquid under the action of a constant volume force, allowing for surface tension. An approximate solution of the equation of flow was found which showed that the unidirectional flow established experimentally by a system of workers had a more stable character than the laminar flow. Wave shape, phase velocity, and amplitude are given. The theoretical values of the critical surface energy characteristics for the inception of the unidirectional flow agree with the experimental data. The rapid dispersion of coloring matter along the flow observed by Friedman and Heller (Adm. 1992 (1964)) is quantitatively explained by the unidirectional character of the flow.</p>		<p>3132</p> <p>A 53 d</p>
<p>ASD-51A METALLURGICAL LITERATURE CLASSIFICATION</p>		<p>13000 000179</p>
<p>13000 000179</p>		<p>13000 000179</p>

SA

3133

592.547 : 593.601.34 : 526.37 -- 52-

Under flow of this type of a viscous liquid. It
flow in contact with a gas flow and with heat transfer.
KARSTEN, P. L. *J. Appl. Phys.*, 34, 19-26 (Jan.,
1963) In Russian.—The paper deals with the inter-
action of a gas flow with the flow of a liquid. On the
assumption of an interruption in the gas flow occurring
where it makes intimate contact with the wave surface of
the liquid it becomes possible to explain and define
continuously the increased pressure drop in a gas stream
flow through pipes with wavy walls. The expression for
the critical velocity at which the gas current is "choked"
in a vertical pipe along the walls of which there is a
liquid contribution is in good agreement with test results.
Finally, the increase of the thermal conductivity of thin
layers of a liquid in an unsteady condition is estimated.

ASSOCIATED METALLURGICAL LITERATURE CLASSIFICATION

FROM SOURCE

RELIST ONE ONLY SEE

1ST AND 2ND ORDERS		PROCESSES AND PROPERTIES INDEX		3RD AND 4TH ORDERS	
<div style="display: flex; justify-content: space-between;"> SA AS 3 d </div> <p>532.99 : 532.13</p> <p>2366. Wave flow of thin layers of a viscous fluid. <i>See</i> Experimental study of wave flow conditions. K. YUKA, P. L. AND KARTVA, S. P. <i>J. Exp. Theor. Phys., USSR</i>, 19 (No. 2) 165-20 (1949) <i>In Russian</i>.—</p> <p>A method of taking photographic diagrams of a lamina of a viscous fluid with a view to studying the free flow on the outer wall of a cylindrical tube. The necessary conditions for the existence of a 2-dimensional wave-flow of a lamina were found. Quantitative determinations of the amplitudes, phase velocities and wavelengths were carried out for a number of flow types of water and alcohol. A series of photographs of sections of flow laminas are given. The results are compared with the theory worked out in the foregoing part of the paper. Experimentally it could be shown that the wave flow due to a certain critical effect is more stable than the laminar one. The magnitude of the critical effect, as found by experiment for water and alcohol, is in good agreement with theory. Two distinct types of undular flow</p> <p>were established; the first, in close agreement with theory, with a wave shape nearing a sinusoid, was called periodic regime, whilst the second is a new type, consisting of single waves moving independently of each other. The empirically found dependence for the periodic regime of amplitudes, phase velocity and wavelength on the effect again corresponds to the theoretical predictions within the limits of accuracy of the approximations made.</p> <p style="text-align: right;">B. P. K.</p>					
<p>459-514 METALLURGICAL LITERATURE CLASSIFICATION</p> <p>1900-1910 1911-1920 1921-1930 1931-1940 1941-1950 1951-1960 1961-1970 1971-1980 1981-1990 1991-2000</p>					

AMS/A-10

**1950
J**

7-77
Kamien, P. — K vopros ob obrazovanii vetrov morekhizh voln. (On the question of the formation of wind waves at sea.) *Akademiya Nauk, SSSR, Doklady*, 64(1):513-516, 1968. 3 vols. DWB—Consideration of difference of pressure on two sides of a wind-wave gives theoretical results close to the experimental. *Subject Headings:* Wind waves, Oceanography.

ASD-SLA METALLURGICAL LITERATURE CLASSIFICATION

FROM 510212100

TO 510212100

DATE 01-01-1977

RECEIVED 01-01-1977

Mechanics

S.A.

sect. A

531.519
 The dynamical stability of a problem whose point of suspension is fixed, P. L. Karna, 28, Eksp. Fiz., No. 24, 298-297 (No. 5, 1951) in Russian.
 The movement of the pendulum is considered under the following conditions: (1) The amplitude α of the oscillations of the suspension is small compared with the length l of the pendulum; (2) the angular frequency of the oscillations of the suspension is high compared with that of the oscillations of the pendulum itself. It is shown that the oscillations of the suspension produce a movement of known the value of which does not depend explicitly on time and the length of the pendulum, but is determined by the mass of the pendulum and by the square of the velocity of the suspension oscillations. This movement is called the vibration movement; it tends to orientate the rod of the pendulum in the line of the oscillations of the suspension. The conditions of stability are found for the case where the C.G. of the pendulum is above the point of suspension. The value of the vibration movement is given for the case of harmonic oscillations of the suspension. An apparatus for determining the vibration movement by mechanical means is described. Vertical oscillations of the suspension point, of a period smaller than that of the pendulum, will always excite the movement of the pendulum. The problem of the possibility of obtaining an orienting effect of a vibration movement on a rigid pendulum and on a flexible is discussed.

Engineering

6461

THERMAL CONDUCTANCE AND DIFFUSION IN LIQUID
MEDIUM IN THE CASE OF PERIODIC FLOW. I. DETER-
MINATION OF COEFFICIENT OF WAVE TRANSFER IN A
PIPE, SLIT, AND CHANNEL. P. L. Kapitza. *USSR*
Zhurnal i Teoriya. Fiz. St. 66(1961) Sept. (In Russian)
Increase of thermal and diffusional transfer in a liquid
with oscillating motion is characterized by a tensor gamma.
called the coefficient of wave transfer. A method of approx-
imate computation of this coefficient enabling the upper limit
to be found, if velocity distribution of flow is known, is de-
scribed. This method is applied to study of transitional
phenomena in case of oscillating processes in pipes, slits,
and open channels.

Mechanics (Dynamics, Statics, Kinematics)

AMS

600. Kapitun, P. L., Pendulum with vibrating suspension (in Russian).
Usp. Fiz. Nauk 66, 1, 7-20, May 1961.

A simple pendulum whose point of suspension is in sinusoidal vertical motion is considered. This is a case of parametric excitation described by a Mathieu equation. (Author does not seem to be aware of existing literature on the simple or double pendulum excited in this fashion.) Some approximate quantitative results are derived, but author's main attention is on the details of a physical mechanism of the system as a demonstration experiment. Some results: The existence of a stable equilibrium for an inverted pendulum; parametric resonance at certain excitation frequencies. Interpreting the pendulum as a clock, one finds that if the suspension oscillation frequency is below the natural frequency, the clock gains. From this gain, one can calculate the mean energy of the excitation spectrum.

Robert E. Robertson, USA

Kaplan, P. I. The computation of the sums of negative
even powers of roots of Bessel functions. *Izv. Akad.
Nauk SSSR (N.S.)* 77, 561-564 (1961).
Let $\lambda_1, \lambda_2, \dots$ be the positive zeros of $J_\nu(x)$
in ascending order, and put $\mu_k = \lambda_k^2$.
Then for $\nu = 1/2, 3/2, 5/2, \dots$

Source: *Mathematical Reviews*, Vol. 13 No. 2

BUTUZOV, V. P.: GONIKBERG, M. G.: KAPITSA, P. L., akademik

~~.....~~
Melting points of tin and lead under pressures up to $34,000 \text{ kg/cm}^2$. Dokl.
AN SSSR 91 no. 5:1083-1084 Ag '53 (MLRA 6:3)

1. Akademiya nauk SSSR (for Kapitsa). (Tin) (Lead) (Melting points)

KAPITSYAN
MESMEYANOV, A.N., akademik; TOPCHYEV, A.V., akademik; IOFFE, A.F., akademik;
KAPITSA, P.L., akademik; LAVRENT'YEV, M.A., akademik; SKOBELETSKY, D.V.,
-AKADEMIK; FOK, V.A., akademik

Albert Einstein; obituary. Vest. AN SSSR 25 no.5:67-68 My '55.
(Einstein, Albert, 1879-1955) (MIRA 8:7)

Adm. P. 2

AID P - 2839

Subject : USSR/Electricity
Card 1/1 Pub. 27 - 28/30
Authors : Academicians A. N. Nesmeyanov, A. V. Topchiyev,
A. F. Ioffe, P. L. Kapitsa, M. A. Lavrent'yev,
D. V. Skobel'syn, V. A. Pok
Title : Albert Einstein (3.14.1879-4.18.1955) (Current
events)
Periodical : Elektrichestvo, 6, 85-86, Je 1955
Abstract : On the occasion of the death of Albert Einstein,
the undersigned academicians present a short homage
to commemorate his scientific activities.
Institution : None
Submitted : No date

"APPROVED FOR RELEASE: 06/13/2000

CIA-RDP86-00513R000520430003-4

APPROVED FOR RELEASE: 06/13/2000

CIA-RDP86-00513R000520430003-4"

KAPITSA, P. I.

USSR/Physics - Ball lightning

Card 1/2 Pub. 22 - 13/51

Authors : Kapitsa, P. I., Academician

Title : The nature of ball lightning

Periodical : Dok. AN SSSR 101/2, 245-248, Mar 11, 1955

Abstract : A new theory concerning the nature of ball lightning is presented. The existence of short electromagnetic waves, the formation of clouds of ionized gases in the air during the common lightning phenomenon are considered, by the new theory, as necessary conditions for ball lightning. However, for the ball-lightning phenomenon to take place, the ionized gaseous cloud should be in the state of resonance with the short wave electromagnetic

oscillations because the cloud, according to the theory, derives its energy from short-wave electromagnetic oscillation by absorbing it. This can be accomplished effectively (up to glowing state) only if the cloud is in the state of resonance. Seven references: 3 English, 2 German and 2 USSR (1923-1952).

Institution :

Submitted :

Acad. Sci. USSR, Physical Lab.

USSR/ Miscellaneous - Anniversaries

Card 1/1 Pub. 124 - 9/39

Authors : Kapitsa, P. L., Academician

Title : The 250-th birthday of Benjamin Franklin

Periodical : Vest. AN SSSR 26/2, 63-75, Feb 1956

Abstract : Excerpts are presented from the introductory speech by the president of the Academy of Sciences, USSR, Academician A. N. Nesmeyanov presiding at the special session honoring the 250-th birthday of Benjamin Franklin. The scientific activities and contributions of B. Franklin were read by the author of this report.

Institution :

Submitted :

SMELYANOV, A.N.; TOPCHYEV, A.V.; KURCHATOV, I.V.; SKOBELEV, D. .;
KAPITSA, P.A.; IOFFE, A.F.; VINOGRADOV, A.P.; KERNBERG, I.G.; TIKHONOV,
N.S.; FADYEV, A.A.; FRANK, I.M.; VEKSLER, V.I.; KORNICHUK, A.Ye.;
POPOVA, N.V.; LEBEDEV, Z.A.; VASILEVSKAYA, V.L.; PETROVSKIY, I.G.;
ALEKSANDROV, A.D.; ARTSIMOVICH, L.A.; MESHCHERYAKOV, M.G.

Irene Joliet-Curie; obituary. Vest.AN SSSR 26 no.4:73-72 Ap '56.
(Joliet-Curie, Irene, 1897-1956) (MIRA 9:7)

KAPITSA, P.L., akademik

Let us set our stake on youth. Tekh.mol. 26 no.2:2-3 '58.

(Siberia--Research)

(MIRA 11:2)

KAPITSA, P.L., akademik

Organization of research. Mir nauki no.5:14-17 '59,
(Research) (Science and state) (MIRA 12:9)

24.3000

75324
SOV/57-29-10-1/1

AUTHORS:

Kapitsa, P. L., Pok, V. A., Vaynshteyn, L. A.

TITLE:

Static Boundary Problems for a Hollow Cylinder of Finite Length

PERIODICAL:

Zhurnal tekhnicheskoy fiziki, 1959, Vol 29, Nr 10, pp 1177-1187 (USSR)

ABSTRACT:

The paper considers the electrostatic potential of an ordinary layer of charges distributed at a certain surface density over a hollow cylinder of finite length. Such a cylinder may be a piece of a round tubing. The purpose of the study is to develop a general method of solution of integral equations for electrostatic problems giving the relationship between the surface density and its potential in conducting cylinders of finite length. Such problems frequently occur in mathematical physics, there being no general method for their solution. When the length of hollow cylinders is sufficiently big the problem is practically equivalent to a case of solid cylindrical conductors. The paper is of a highly mathematical nature. A hollow cylinder is represented in cylindrical coordinates, and a Laplacian equation for the potential

Card 1/3

Static Boundary Problems for a Hollow Cylinder of Finite Length

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V_s of an ordinary layer of surface charge of density S is written. It is stated that this equation may be reduced to an infinite number of linear equations, if the known function $V_s(z)$ may be resolved within $-L < z < L$ (L being one half of the length of the cylinder) range into a series of any system of functions. The equation may also be applied to sufficiently short cylinders (narrow rings) when $L/a \ll 1$, where a represents the radius of the cylinder. Each of the infinite number of linear equations is the summation of $A_n q U_n$ products, where U_n are unknown coefficients and A_n represents the system coefficients. For very long cylinders the system coefficients A_n are functions of L/a . Two methods are discussed for the determination of A_n coefficients. The first method applies to relatively short cylinders where $0 < L/a \ll 1$. Here the A_n coefficients are represented as a summation of a convergent series of Bessel functions, and at values $L/a \gg 1$ an explicit formula for these coefficients may be had by using the iterative method. The second method discusses cases where $L/a \gg 1$. Using Mellin's transformation [Ref 4], Bessel and Gamma Functions [Ref 1], and Meyer functions [Ref 2], A_n is represented as

Card 2/3

Static Boundary Problems for a Hollow Cylinder of
Finite Length

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SOV/57-29-10-1/13

matrix form the solution of which results in a fourth-order linear differential equation which can be applied to cases where $L/a > 1$ as well as to those where $L/a \leq 1$. The shape of this fourth-order equation is suitable for the solution on high-speed computing machines of electrostatic problems of the type discussed. There are 6 references, 1 Soviet, 3 U.S., 1 Swedish, 1 non-Soviet.

ASSOCIATION:

Institute for Physical Problems, Academy of Sciences, USSR, Moscow
(Institut fizicheskikh problem, AN SSSR)

SUBMITTED:

March 4, 1959

Card 3/3

9.1000,24.3000

75325

SOV/57-29-10-2/18

AUTHORS:

Kapitsa, P. L., Fok, V. A., Vaynshteyn, L. A.

TITLE:

Symmetrical Electrical Oscillations of an Ideally Conducting Hollow Cylinder of Finite Length

PERIODICAL:

Zhurnal tekhnicheskoy fiziki, 1959, Vol 29, Nr 10, pp 1188-1205 (USSR)

ABSTRACT:

The subject matter of the paper is the problem of electromagnetic oscillations of an ideally conducting cylinder. It is a problem with which radio engineering is concerned when antenna vibrators are designed. This study, however, is limited to the case when current density on the surface of the cylinder is uniform and has a longitudinal component only, but it applies to very thin as well as to larger-size solid conductors. Oscillations that take place in such cases are called symmetrical electrical oscillations. The study is of a highly mathematical nature. Basically, it operates with two functions: potential V , which is known, and current density U , which is unknown. The reasoning starts with an integral equation of the potential written within boundary conditions of the

Card 1/4

Symmetrical Electrical Oscillations of an Ideally
Conducting Hollow Cylinder of Finite Length

75325

SOV/57-29-10-2/18

surface of the cylinder so as to satisfy the Sommerfeld radiation principle. After the application of Bessel, Macdonald, and Hankel functions to the solution of this equation, and using the Neumann multiplier and Legendre polynomial, a relationship in the form of an integral equation is obtained between the V and the U functions. This latter equation is then transformed into an infinite system of linear equations relating V and U. In order to accomplish this an approximate expression is developed for the potential function V resolved in a Fourier series. The approximate expression is good for conditions when $a/L \ll 1$ and $ka^2/2L \ll 1$, where L is one half of the cylinder length, a is its radius, and $k = 2\pi/\lambda$; λ being the wavelength. The current density function U may also be resolved in a Fourier series for any even or odd function. It is stated that when the function V is neither even nor odd it may always be represented as a sum of the even and odd functions, for each of which a corresponding U function, even and odd, must be found. The sum of the latter will give the sought-for current on the surface of the cylinder. The coefficients of the members of these equations, resolved in series, form infinite matrices. These are resolved into the sum of the diagonal matrix and the general

Card 2/4

Symmetrical Electrical Oscillations of an Ideally
Conducting Hollow Cylinder of Finite Length

75325

SOV/57-29-10-2/18

one; expressions are then given for their computation, and it is shown that a solution may be obtained without the necessity of calculating the determinants but by the application of the iterative method. Prior to using this method, however, the undetermined constants of the equations must first be found, for the calculation of which formulas are developed. The developed theory is compared with the theory of thin antenna vibrators. A distinction is made between short vibrators, with $k \ll g$, and long vibrators, with $k \gg g$ (here, $g = \pi/2L$; the other symbols have already been defined). The fact that electrostatic charges accumulate at the ends of the vibrators causes the error in short vibrators to be greater than in the long ones. In either case current distribution along the axis of the vibrator is similar to that in an open-circuit homogeneous transmission line. Conditions are given for the system of equations to have full regularity, in which case they represent cylinders that are very thin, with $a \rightarrow 0$, and to the solution of which the iterative method may be applied [Ref 3]. The method discussed in the paper may also be applied to the solution of electrostatic problems. The difference between this method and the one proposed in Ref 2 is that in the

Card 3/4

Symmetrical Electrical Oscillations of an Ideally
Conducting Hollow Cylinder of Finite Length

75325

SOV/57-29-10-2/18

latter the density of the electric charge on the surface of a hollow cylinder was represented by a series each member of which showed absence of a requirement for a charge at the ends of the cylinder, while in the presently proposed method the poor convergence of the series signifies that charges are being concentrated at the cylinder ends. The ends of the cylinder have effect only in case of short cylinders ($L/a \ll 1$). When long cylinders are being considered ($L/a \gg 1$), the proposed method may well be used. For large values of kL this method is cumbersome. In such a case, if the antenna vibrator is thin ($ka \ll 1$), the method given in Ref 6 is the more preferable. The method discussed in this paper is suitable for the solution on high-speed computing machines of the type of problems discussed. There are 6 references, 4 Soviet, 1 U.S., 1 Swedish.

ASSOCIATION: Institute for Physical Problems, Academy of Sciences, USSR, Moscow
(Institut fizicheskikh problem, AN SSSR)

SUBMITTED: March 4, 1959

Card 4/4

KAPITSA, P.L., akademik

Future of science. Mir nauki : no.3/4:3-9 '60.

(Science and civilization)
(Scientists)

(REF 14:10)

21547

S/057/61/031/004/013/018
B125/B202

11.3120 (440 3416, 4216)

AUTHORS: Kapitsa, P. L. and Danilov, I. B.

TITLE: Expansion engine for the liquefaction of helium

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 31, no. 4, 1961, 486-494

TEXT: The authors describe the new expansion engine which has been developed at the Institut fizicheskikh problem (Institute for Physical Problems). This engine was used for the construction of two types of aggregates: one with a yield of 5 l/sec operating with previous cooling by liquid nitrogen and the second with a yield of 14 to 18 l/sec with cascade-type operation and two helium expansion engines which required no other coolants. The design principles of the expansion engine are similar to those which have been suggested already earlier (P. Kapitsa, Proc. Roy. Soc., A147, 189, 1934; P. L. Kapitsa, UFN, XVI, 2, 145, 1936). The expansion cylinder and the piston operate at low temperatures. Fig. 1 shows the total view of the engine. The most important parts of this engine are the cylinder and the piston. Because of the "gas lubrication" cylinder and piston must maintain their exact cylindrical form also at

Card 1/14

21547

Expansion engine for the ...

S/057/61/031/004/013/018
B125/B202

very low temperatures. This construction, however, is very sensitive to impurities. In the recent constructions, the piston is coated with plastic material and the cylinder is chromium-plated. In the first expansion engine the expansion process was reduced with respect to the inverse motion, i.e., the piston was "shot out". Because of its irregular operation this mechanism was replaced by a cam gear. Owing to the use of plastic material the duration of expansion can no longer be reduced. The gas is distributed in the expansion engine by special valves. In practice, the operation of the engine is regulated according to the indicator diagram. Fig. 3 shows three such indicator diagrams. In the helium liquefaction machines described the purity of the gas is of decisive importance. Table 1 gives some characteristic data on the expansion engine with a power of 5-6 l per hr with previous nitrogen cooling. Fig. 4 shows the principle of design of the liquefaction machine. The pure gaseous helium passes from the gas holder 1 into the piston compressor 2 and is compressed until a pressure of about 25 atm is attained. It then passes from the compressor into the liquefaction aggregate 3. In the first section of the heat exchanger it is cooled by a helium countercurrent and by gaseous nitrogen. In the second section of

Card 2/12 4

21547

Expansion engine for the ...

S/057/61/031/004/013/018
B125/B202

the heat exchanger the helium is then cooled to 27°K. At this temperature 65% of compressed helium are introduced into the expansion engine and cooled to 12°K. The remaining part of liquid helium is then cooled in the third and fourth section of the heat exchanger. It is expanded in the throttle valve and partly liquefied, and finally collected in a Dewar vessel 4. Fig. 5 shows the design of this liquefaction machine, and Table 2 contains its most important parameters. Such apparatus are now being industrially produced. Besides this liquefaction machine, the authors also developed a cooling device with two expansion engines connected in cascade. The following designers are mentioned: Yu. Yu. Lur'ye, K. I. Skorlupin, V. Ye. Keylin, mechanic A. M. Goncharov, S. A. Mrysh, V. A. Gdovskiy, A. V. Melekhin and F. N. Boyev, S. A. Yakovlev, who are in charge of instrument maintenance. There are 6 figures, 2 tables, and 8 references: 3 Soviet-bloc and 5 non-Soviet-bloc. The most recent reference to English-language publications reads as follows: P. Fortescue, W. B. Hall, Journ. Brit. Nuclear Energy Conf., 2, 2, 83, 1957.

Card 3/12

21547

Expansion engine for the ...

S/057/61/031/004/013/018
B125/B202

ASSOCIATION: . Institut fizicheskikh problem im. S. I. Vavilova Moskva
(Institute for Physical Problems imeni S. I. Vavilov,
Moscow)

SUBMITTED: August 20, 1960

Legend to Fig. 1: Principle of design of the expansion engine:
1 - cylinder, 2 - piston, 3 - rod, 4 - inlet valve, 5 - filter,
6 - inlet receiver, 7 - outlet valve, 8 - outlet receiver, 9 - compensators,
10 - stuffing box of the inlet valve, 11 - stuffing box of the outlet
valve, 12 - crosshead piston, 13 - condensation cups (uplotnitel'nyye
manzhety), 14 - crankshaft, 15 and 16 - cam for the supply of the outlet
valve and the inlet valve, 17 - generator for the indicator, 18 - tensometer

Card 4/4

PHASE I BOOK EXPLOITATION

SOV/6295

Kapitsa, Petr Leonidovich, Academician

Elektronika bol'shikh moshchnostey (High-Power Electronics) Moscow, Izd-vo AN SSSR, 1962. 194 p. Errata slip inserted. 5000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut fizicheskikh problem. Fizicheskaya laboratoriya.

Eds.: L. A. Vaynshteyn and G. G. Gus'kov; Tech Ed.: A. P. Guseva.

PURPOSE: This book is intended for engineers and scientists engaged in the field of electronics. It may also be used as a textbook for advanced students and aspirants specializing in ultrahigh-frequency electronics.

Card 1/4

High-Power Electronics

SOV/6295

COVERAGE: This collection is the first of a series scheduled for publication and based on projects which have been carried out in the laboratory of P. L. Kapitsa, Academician, and devoted to the development of high-power electronics, especially in the field of high-power, high-frequency electron oscillations and their conversion into other forms of power. The solution of these problems will offer new possibilities for the effective utilization of those oscillations in power engineering and would open new prospects for electrical engineering. The book includes the monograph "High-Power Electronics" and the article "Fundamental oscillations of cavity resonators with grid partition," both written by P. L. Kapitsa, in which the theoretical foundations of high-power, super-high frequency magnetrons are discussed. Some results of experiments and the theory of electromagnetic oscillations in resonators are analyzed. The initial portion of the work was conducted by the author in close cooperation with S. T. Filimonov and S. P. Kapitsa, and with the assistance of V. A. Pok. The author thanks L. A. Vaynshteyn for his cooperation. There is no bibliography.

Card 2/4

High-Power Electronics

SOV/6295

TABLE OF CONTENTS:

Foreword	5
Introduction. Tasks of high-power electronics	6
Ch. I. Solution of Basic Equation for Charged Particle Motion by the Method of Time Averaging	17
Ch. II. Motion of Electrons in a Plane-Parallel Magnetron (Planotron)	30
Ch. III. Basic Indices of Plane-Parallel Magnetron	44
Ch. IV. Plate and Cathode Losses in the Plane-Parallel Magnetron	62
Ch. V. Edge Effect and Losses Involved	74

Card 3/4

High-Power Electronics

Ch. VI. Magnetron Theory

807/6295

Ch. VII. Experimental Investigations of Electron Processes in a Plane-Parallel Magnetron

52

Ch. VIII. Larmor Orbit in HF Field

113

Ch. IX. Prospects of High-Power Electronics Development
Fundamental oscillations of cavity resonators with grid partition

129

1. Rectangular cavity

147

2. Computation of the capacity λ

159

3. Natural oscillations of a cylindrical cavity with a grid

161

4. Resonance cavities with grid partitions

175

181

190

AVAILABLE: Library of Congress

SUBJECT: Electronics

Card 4/4

5/29/53
RZ/fmr/gm

KAPITSA, P.L., akademik

Future of science. Nauka i zhizn' 29 no.3:18-23, 96-97 N- '62.

(Science)

(MIRA 15:7)

S/057⁷⁶⁵/62/032/004/011/017
B139/B102

11.31.20

AUTHORS: Kapitsa, P. L., and Danilov, I. B.

TITLE: Cascade expansion condenser for helium without additional coolants

PERIODICAL: Zhurnal tekhnicheskoy fiziki, v. 32, no. 4, 1962, 457-460

TEXT: A description is given of the laboratory system Г-1 (G-1) with two cascade-connected pressure reducers. The condenser capacity is 18 l/h

(with a 2 CA-30 (2 SA-30) "Borets" compressor for 250 m³/hr); starting period of the system, about 2 hrs; power consumption for producing one liter of liquid helium, 2.2 kw·hr; gas temperature behind the pressure reducer of the second stage, 11-12°K, and behind that of the first stage, 65°K. Helium gas is compressed to 20-25 atm and divided into three streams in the condenser: 35% is conveyed to the pressure reducer of the first stage with 125-130°K, 35% is conveyed to the pressure reducer of the second stage with 28°K, and 30% is allowed to expand in the last section of the heat-exchanger and filled into a container which is

Card 1/2

Cascade expansion condenser for ...

S/057/62/032/004/011/017
B139/B102

insulated by a vacuum double casing. The hydraulic resistance of the heat exchanger is 0.07 atm for the reflux. The helium condenser was designed and built with the assistance of the designers Yu. Yu. Lur'ye and K. I. Skurlupin, as well as the mechanics A. V. Melekhin, F. N. Boyev, V. A. Gdovskiy, A. M. Goncharov, and S. A. Yakovlev. There are 4 figures.

ASSOCIATION: Institut fizicheskikh problem AN SSSR, Moscow
(Institute of Physical Problems AS USSR, Moscow)

SUBMITTED: July 14, 1961

Card 2/2

KAPITSA, P.L., akademik

Power electronics. Nauka i zhizn' 30 no.3:8-12 Mr '63.

(Electronics) (Electric engineering)

(MIRA 16:5)

KAPITSA, Petr Leonidovich, akademik

High-power electronics. Priroda 53 no.2:21-30 '64.
(MIRA 17:9)

KAPITSA, P.L., akademik; FILIMONOV, S.I.; KAPITSA, S.P.

Theory of electronic processes in a magnetron generator with
continuous power output. Elektron. bolsh. moshch. no.3:
7-35 '64. (MIRA 17:9)

1. Otvetsvennyy redaktor zhurnala "Elektronika bol'shikh
moshchenostey" (for P.L. Kapitsa).

ly by their resonant systems which, in nigonrons, produce in-phase oscillations of slots. Thus, in a nigonron, O-type oscillation is produced in place of the

ACCESSION NR: AT4047273

O-type oscillation which takes place in a magnetron. During operation of a nigonron, a H₀₁ oscillatory mode is excited in the cylindrical resonator. Several two-row nigonrons were fabricated; they were found to start to oscillate at a frequency of 100 GHz. In the first models the efficiency was 10-15%. Further development of the nigonron is required. The main performance characteristics of the nigonron are: power output, efficiency, and reliability. The nigonron is operating for several years and has proven reliable.

The trajectories of electrons in a two-row nigonron were also theoretically investigated; it was found that a two-row nigonron has very stable phase focusing and a strong coupling between the oscillations in the active region and the resonator volume. Orig. art. has. 9 figs and 4 refs.

ENCL: 00

OTHER: 000

L 8107-66 EWT(1)/EWA(h)

ACC NR: AT5027152 SOURCE CODE: UR/3055/65/000/004/0007/0052

AUTHOR: ^{44, 55} Kapitsa, P. L. (Academician)

ORG: None

TITLE: Converters of H waves into E waves

SOURCE: AN SSSR. Fizicheskaya laboratoriya. Elektronika bol'shikh moshchnostey, no. 4, 1965, 7-52

TOPIC TAGS: ⁷⁵ waveguide, helical waveguide, waveguide element, waveguide propagation, wave conversion ^{21, 44, 55}

ABSTRACT: In the course of experimental utilization of high-intensity wave generators it became necessary to convert H_{01} waves completely into E_{01} waves, leading to the need for designing effective wave converters. The author attempts to solve the problem, which was posed as follows: an H wave propagating in a waveguide had to be converted in such a way as to have only an E wave after conversion in the waveguide. This problem was then reduced to rotating the vector of the electric and the magnetic field at every point of the transverse cross section of the waveguide in the same direction at a 90° angle. The author first examines the conversion and the reflection of waves by gratings and formulates a general theory of conversion based on the equivalent scheme. It is then shown how a system incorporating three gratings rotates the plane of polarization of a plane wave by 90° , using unrestricted plane waves propagating along the z axis from left to right. The three gratings in the waveguide are presented in a

Card 1/4

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ACC NR: AT5027152

diagram (see Fig. 1).

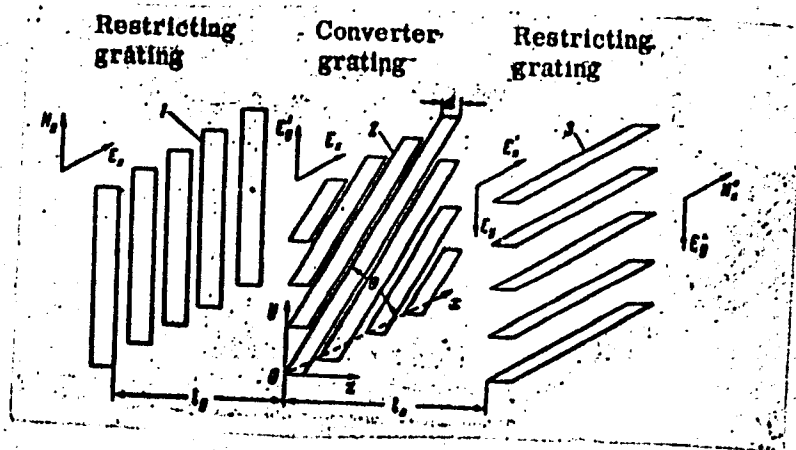


Fig. 1. Converter-system with three gratings

Card 2/4

L 8107-66

ACC NR: AT5027152

The design of a helical "spider" converter is proposed; it completely converts an H_{01} wave into an E_{01} wave (in cylindrical waveguides). The design of the "spider" converter is discussed and illustrated (see Fig. 2). It is concluded that according to the theoretical and the experimental

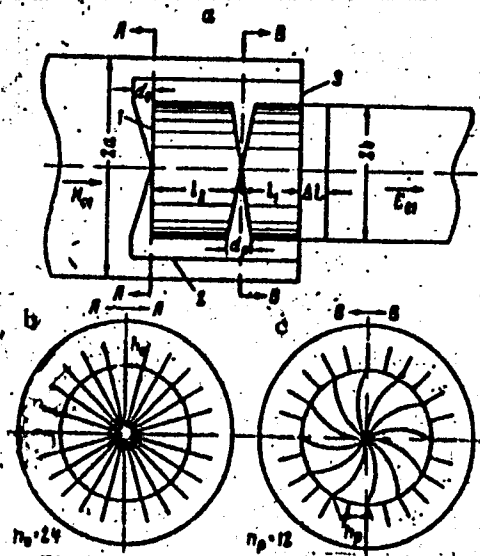


Fig. 2. The spider converter

- a - Longitudinal cross section;
- b - grating 1 (cross section A-A);
- c - grating 2, spider (cross section B-B).

Card 3/4

ACC NR: AT5027152

data obtained, the three-grating method makes possible the conversion of any H wave into the corresponding E wave. Most of the attention was devoted to converting the H_{01} wave into the E_{01} wave, a matter of practical interest to the author. It is also possible to convert the H_{m1} wave into the E_{m1} wave. The author expresses his gratitude to L. A. Vaynshteyn for discussing the theory and to S. I. Filimonov for assistance in developing the design of the converter. Orig. art. has: 9 figures and 137 formulas. [08]

SUB CODE: 09/ SUBM DATE: 16Aug64/ ORIG REF: 002/ OTH REF: 001/ ATD PREIS: 4146

Card 4/4 (u)

L 7949-66 EWT(1)/EWA(h)

ACC NR: AT5027153

SOURCE CODE: UR/3055/65/000/004/0053/0065

AUTHOR: Kapitsa, P. L. (Academician); Prozorova, L. A.

ORG: none*

TITLE: Experimental study of a wave converter

SOURCE: * AN SSSR. Fizicheskaya laboratoriya. Elektronika bol'shikh moshchnostey,
no. 4, 1965, 53-65

TOPIC TAGS: helical waveguide, waveguide transmission, waveguide element, *electronic transformer*

ABSTRACT: The authors attempted to solve two problems during the experimental investigation of a spiral transformer of H_{01} and E_{01} waves described on p. 7 on the present work: a) to determine, within the prescribed frequency range, the coefficients of reflection and wave transmission of the wave converter; these values must be known for the efficient application of the converter. b) To improve the performance characteristics of the converter. The theory of the three-grating spiral converter presented in the reference cited shows that, although it is possible to construct a converter for the prescribed frequency which would be completely matched and would have total wave transmission, the theory provides only approximate expressions for the dimensions of the various elements. Measurements performed showed that the converter built according to the approximate specifications would assure wave transmission up to 97-98%.

Card 1/3

L 7949-66

ACC NR: AT5027153

Corrections have to be introduced into the calculated dimensions of the elements in order to improve the transmission capacity. These corrections are obtained by an experimental method described in the present article. An experimental setup by means of which the measurements were performed is shown in a diagram (see Fig. 1). The

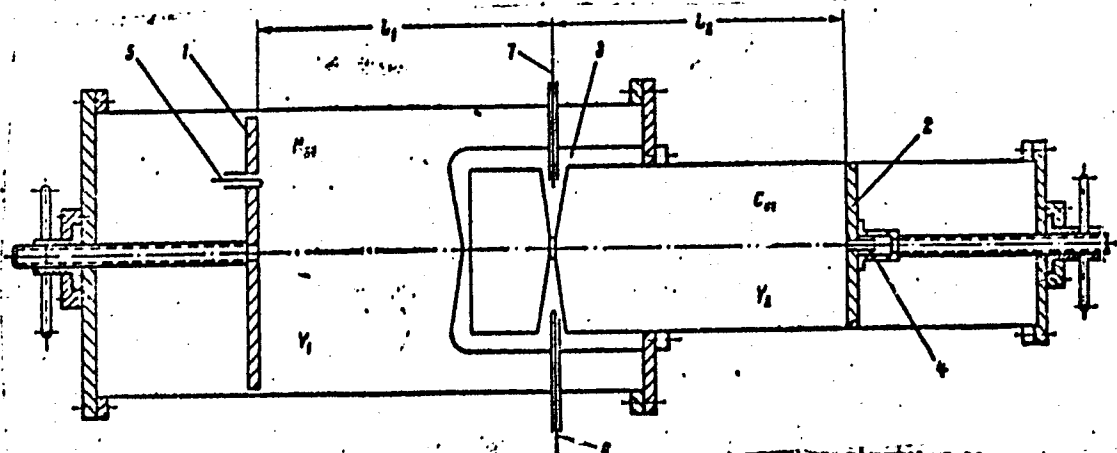


Fig. 1. Experimental setup for measuring the parameters of the spider-like converter

1 and 2 - Pistons; 3 - transformer; 4 - loop; 5, 6, and 7 - probes.

Card 2/3

L 7919-66

ACC NR: AT5027153

authors also determined experimentally the transmission capacities of the gratings, as well as the performance capabilities of the entire system. These measurements were conducted by conventional methods; the experimental results agree sufficiently well with the theoretical data but are not given in the article. In the performance of this work, the authors received a great deal of assistance from laboratory technicians V. S. Zakirov and K. I. Rassokhin, to whom the authors express their gratitude. Orig. art. has: 6 figures and 22 formulas. [08]

SUB CODE: 09/ SUBM DATE: 21Oct64/ ORIG REF: 003/ ATD PRESS: 4147

BC
Card 3/3

L 11617-66 ENT(1)/EWA(h) LIP(c)

ACC NR: AT5027163

SOURCE CODE: UR/3055/65/000/004/0206/0211

AUTHOR: ^{41,55} Kapitsa, P. L. (Academician)

ORG: none

TITLE: Absolute measurement of r-j' field in resonator ²⁵

SOURCE: AN SSSR. Fizicheskaya laboratoriya. Elektronika bol'shikh moshchnostey, no. 4, 1965, 206-211

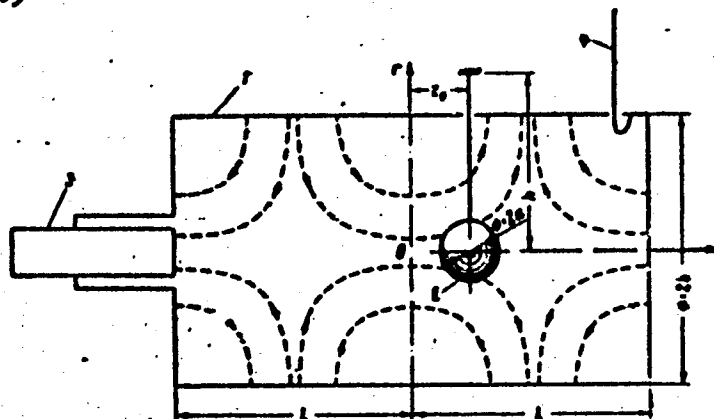
TOPIC TAGS: cavity resonator, electromagnetic field, electric field, mag netic field

ABSTRACT: A new method of absolute ^{9M} measurement of ^{21,44,55} electric or ^{21,44,55} magnetic field is suggested in which a light-weight conducting sphere suspended in a cavity resonator is deflected by the field, see fig. A hollow Al or Ag sphere (radius $a \approx 0.5$ --1 cm, mass 1--2 g) suspended by a quartz fiber is deflected through about 1 mm by an electromagnetic field (mode E_{01} in the figure) of about 10 oe (or 3000 v/cm). An accuracy of 2--3% is claimed for the laboratory hookup used, and higher accuracy is believed attainable. As the measuring sphere quickly heats up, it is recommended that the reading be taken within 1 min. Orig. art. has: 1 figure and 12 formulas.

Card 1/2

L 11617-66

ACC NR: AT5027163



SUB CODE: 09, 20/ SUBM DATE: 15Dec63/ ORIG REF: 003/

beh
Card 2/2

ARTSIMOVICH, L.A., akademik; KELEYSH, M.V., akademik; KAPITSA, P.L., akademik;
VUL, B.M.; VERESHCHAGIN, L.F.; PISTOL'KORS, A.A.; SHCHUKIN, A.N.,
akademik; SKOBEL'TSYN, D.V., akademik; ALEKSANDROV, A.P., akademik;
AMBARTSUMYAN, V.A., akademik; ZEL'DOVICH, Ya.B.; SEMENOV, N.N.,
akademik; KOTEL'NIKOV, V.A., akademik; LIFSHITS, I.M.; VEKSLER, V.I.,
akademik; GINZBURG, V.L.; MILLIONSHCHIKOV, M.D., akademik

Some problems in the development of modern physics; discussion of
the work of the Department of General and Applied Physics. Vest.
AN SSSR 35 no.2:3-46 F '65. (MIRA 18:3)

1. Chleny-korrespondenty AN SSSR (for Vul, Vereshchagin, Pistol'kors,
Lifshits, Ginzburg).

VVEDENSKIY, B.A., glav. red.; VUL, B.M., glav. red.; SHTEYNMAN, R.Ya., zam. glav. red.; BALDIN, A.M., red.; VONSOVSKIY, S.V., red.; GALANIN, M.D., red.; ZERUOV, D.V., red.; ISHLINSKIY, A.Yu., red.; KAPITSA, P.L., red.; KAPISOV, N.A., red.; KOZODAYEV, M.S., red.; LEVICH, V.G., red.; LOYTSYANSKIY, L.G., red.; LUK'YANOV, S.Yu., red.; MALYSHEV, V.I., red.; MIGULIN, V.V., red.; REBINDEL, P.A., red.; SYRKIN, Ya.K., red.; TARG, S.M., red.; TYABLIKOV, S.V., red.; FEYNBERG, Ye.L., red.; KHAYKIN, S.E., red.; SHUBNIKOV, A.V., red.

[Encyclopedic physics dictionary] Fizicheskii entsiklopedicheski slovar'. Moskva, Sovetskaia Entsiklopediia. Vol.4. 1965. 592 p. (MIRA 18:1)

KAPITSA, Petr Leonidovich, akademik; FAYNBOYM, I.B., red.

[A lifetime for science; Lomonosov, Franklin, Rutherford, Langevin] Zhizn' dlia nauki; Lomonosov, Franklin, Rezerford, Lanzheven. Moskva, Izd-vo "Znanie," 1965. 61 p. (Novoe v zhizni, nauke, tekhnike. IX Seriya: Fizika. Matematika. Astronomiya, no.1) (MIRA 18:2)

C.A.

2

Wave flow of thin layers of a viscous liquid. III. Experimental study of the wave flow. P. L. Kapitza and S. P. Kapitza. *Sov. Phys. Dokl.* 10, 105-20 (1969); *cf. ibid.* 10, 3-22 (1969).—By photography, in stroboscopic illumination, of the shadow of a thin layer of liquid flowing down the outer wall of a glass tube, the profile of the liquid film, above a certain crit. flow rate Q_c , is seen to become undulatory. The transition from laminar to wave flow is brought about by a slight, accidental or artificial, perturbation. If the perturbations, in the form of very weak compressed-air impulses, are synchronized with the stroboscope, the wave motion becomes regularly periodic and stable and close to sinusoidal. Another type of motion is obtained by the application of stronger but less frequent impulses: in that case, one observes a sequence of single waves running down the film, with laminar motion between the waves. The crit. Q_c , below which the periodicity disappears and the flow becomes laminar throughout, is related to the crit. Reynolds no. Re_c by $Q_c = 0.25 \cdot Re_c$, where ν = kinematic viscosity. For H_2O at 15° , $Re_c = 21.5$, $Q_c = 0.061$ cc./sec.; for $EtOH$, 13.4 and 0.038. The amplitude a , defined by $(1+a)/(1-a) = a_{max}/a_{min}$, where a = thickness of the film, comes close to the theoretically predicted $a = 0.46$ at flow rates sufficiently above Q_c . The theoretical expressions for the wave length, $\lambda = 7.5 (a/Q_c)^{1/2}$, and for the phase velocity, $h = 1.5 (g/a)^{1/2} Q_c^{1/2}$, where g = surface tension, Q = flow rate (cc./sec.), and g = acceleration of gravity, is verified at $Q = Q_c$: for H_2O , $\lambda = 0.89$ cm., $h = 12.4$ cm./sec., and for $EtOH$, 0.71 and 10.7. However, with further increasing Q , the capil. λ increases and the capil. h decreases more slowly than predicted by the theory. N. Thor

KAPITSA, S.P., and KALASHNIKOV, A. G.

"Magnetic Susceptibility of Rocks Under Elastic Stresses," Dokl. AS USSR
86, No. 3, pp 521-23, 1952.

Translation 563977

KAPITSA, S. P.
USSR/Geophysics

FD-2580

Card 1/1 Pub. 44 10/19

Author : Kapitza, S. P.

Title : Apparatus for calculating the Poisson integral and certain of its application

Periodical : Izv. AN SSSR, Ser. geofiz, ^{No. 4,} Jul-Aug 55, 369-376

Abstract : The author describes an apparatus, whose use is no more complex than a regular planimeter, that effectively solves the first boundary-value problem in the potential theory for the half-plane. He notes that utilization of this integrator simplifies considerably the problems connected with the calculation of two-dimensional potential fields, its use being especially fruitful in the processing of results of aeromagnetic plotting, since the apparatus effectively converts the data of plotting from small heights to greater heights.

Institution : Geophysics Institute, Academy of Sciences USSR

Submitted : May 21, 1954

USSR/Physics of the Earth - General Problems, 0-1

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 36292

Author: Kapitsa, S. P.

Institution: None

Title: Magnetic Properties of Volcanic Rocks During Mechanical Stresses

Original

Periodical: Izv. AN SSSR, ser. geofiz., 1955, No 6, 489-504

Abstract: Description of a procedure for investigating the magneto-elastic effect of weakly-magnetic volcanic mountain rocks in the region of weak magnetic fields, using the induction method. A detailed description is given for a compensation scheme for measuring the susceptibility χ and the reversal-of-magnetization losses of the specimen. The accuracy of the relative measurements of the variations in χ was approximately 1%. The accuracy of determining the stresses in a specimen and the magnetic field intensity was approximately 3%. The accuracy of the absolute measurement of χ and of the losses was approximately 3-10%. Specimens of basalt,

Card 1/2

USSR/Physics of the Earth - General Problems, 0-1

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 36292

Abstract: andesite, diabase, and other volcanic rocks with initial values of χ from 70×10^{-6} to $44,000 \times 10^{-6}$ emu and of artificial specimens made of magnetite and cement powders were investigated. Results of the investigation of the dependence of χ on the mechanical stresses are given in the form of curves, which show the considerable reduction in χ of rocks upon compression. Two types of variations of χ are shown. The fundamental changes are due to the reversible magneto-elastic effect, characterized by a coefficient $C = \chi^{-1} d\chi/d\sigma$ (σ is the load), which equals $0.8-3.3 \times 10^{-4} \text{ cm}^2/\text{kg}$ for all specimens studied. In addition to the reversible changes at low stresses, there were also disclosed irreversible changes in χ , related with the relief of internal stress by external ones. The measured values of losses during the reversal of magnetization are given. It is shown that at audio frequencies, in addition to hysteresis losses, a substantial role is played also by the losses due to after effects. A new method is proposed for measuring the stressed state of mountain rocks, based on the measurement of χ of rocks upon deformation. Bibliography, 12 titles.

Card 2/2

KAPITSA, S.P.

Making quartz torsion filaments. Zav.lab.21 no.9:1132 '55.
(MLRA 9:1)

1. Institut fizicheskikh problem Akademii nauk SSSR imeni
S.I.Vavileva.
(Glass fibers)

FD-3210

USSR/Physics, Magnetism, Measuring of

Card 1/1 Pub. 153-19/28

Author : Kapitsa S. P.

Title : Photoelectric Fluxmeter

Periodical : Zhur. Tekh. Fiz., 25, No 7, 1307-1315, 1955

Abstract : The linear theory of photoelectric fluxmeter, consisting of a galvanometer and an amplifier is described. The theory is based on frequency-characteristic analysis of transient processes. Experimental checking of theoretical computations resulted in improvement of the design. Better response of the apparatus is possible and higher resistances may be applied in the circuit. The same improvements may be applied to a seismograph. Indebted to Prof. A. G. Kalashnikov. Three references, including two foreign.

Institution: --

Submitted : April 9, 1954

Kapitsa, S. P.

USSR / Magnetism, General Problems

R-1

Abs Jour : Ref Zhur - Fizika, No 4, 1957, No 9472

Author : Kapitsa, S.P.

Inst : Not given

Title : Contemporary Problems in Magnetism

Orig Pub : Priroda, 1956,⁴⁵No 10, 51-56

Abstract : Brief survey of the papers delivered at the All-Union Conference on Magnetism, held in Moscow in May 1956.

Card : 1/1

KAPITSA, S.P.

Mechanical computation of harmonically conjugate functions. Vych. mat.
no.1:167-169 '57. (MLRA 10:11)

(Mathematical instruments) (Integrals)

SOV/120-58-2-24/37

AUTHOR: Kapitsa, S. P.

TITLE: A Laboratory Electromagnet (Laboratornyy elektromagnit)

PERIODICAL: Pribery i Tekhnika Eksperimenta, 1958, Nr 2, pp 97-99
(USSR)

ABSTRACT: An electromagnet is described which was designed for general laboratory use and produces 30 kilogauss in a 10 mm gap at a power of 3.6 kw. The design is a compromise between the following requirements: small leakage, convenient disposition of the windings, efficient cooling, accessibility of the working space, and the possibility of convenient change of geometry with a simple and compact construction. A sectional drawing through the magnet is shown in Fig.2 and its characteristics in Fig.3. The limiting current which gives rise to a temperature increase of up to 50°C is 20 amp which corresponds to a current density of 2 amp/mm². The magnet requires 1.6 kw at 80 volts. The magnetic circuit is made from steel plate (40 mm or 45 mm), the core and the pole pieces from C-1 and Armco iron. The weight of the magnet is 600 kg. Without the winding it weighs 188 kg. 50-45° conical pole pieces were found to be the most suitable for d = 58 mm (Fig.3).

Card 1/2

SOV/120-58-2-24/37

A Laboratory Electromagnet.

This is in conflict with the theoretical value of 54° given by Bates in Ref.2. From the slope of the magnetisation curves at small inductions it is concluded that the leakage is small. P. L. Kapitsa and I. N. Yamshchikov are thanked for their interest and help. There are 3 figures and 2 English references.

ASSOCIATION: Fizicheskaya laboratoriya AN SSSR (Physics Laboratory of the Academy of Sciences of the USSR)

SUBMITTED: August 22, 1957.

Card 2/2

1. Electromagnets--Design 2. Laboratory equipment

84399

S/056/60/011/004/017/048
B004/B070

26.2340

AUTHORS: Kapitsa, S. P., Bykov, V. P., Melekhin, V. N.

TITLE: A High-current Microtron /9

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960,
Vol. 39, No. 4(10), pp. 997-1000

TEXT: In the present work, the authors give data so far available on a new 5 - 15 Mev electron accelerator. A microtron with a pole piece diameter of 700 mm and pole separation of 110 mm was constructed. The source of high-frequency oscillations is a pulsed magnetron in the 10-cm range. The authors discuss the different types of resonators used in their experiments. Fig. 1 schematically shows the acceleration of electrons emitted by a cathode of lanthanum boride heated to 1600°C. For a field of 350 kv/cm in the resonator, the emission current density reached the value 200 a/cm². By means of another arrangement of the cathode in the resonator (Fig. 2), a current of 5 ma with an energy of 13 Mev and a magnetic field of 1950 oersteds could be obtained. The

Card 1/3

84399

A High-current Microtron

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efficiency was about 10%, and the efficiency of electron capture about 5%. The authors further discuss the motion of electrons in a resonator with a rectangular cross section. The new microtron can compete with linear accelerators and betatrons in the region of 50 - 100 Mev. Since the electron beam has a narrow spread of energy and momentum, the microtron can serve as an injector for large accelerators. A detailed description of the microtron and calculations will be provided shortly. A high-energy accelerator is being constructed. The authors mention papers of V. I. Veksler (Ref. 1), and Ye. M. Moroz (Ref. 6). They thank Academician P. L. Kapitza for his interest in the work, L. A. Vaynshteyn for discussions, G. P. Prudkovskiy for calculations on his trajectograph, I. G. Krutikova for calculations on a "Strela" computer, and S. V. Melekhin and L. Zykin for help in the work. There are 2 figures and 6 references: 3 Soviet, 2 British, and 1 Canadian.

ASSOCIATION: Institut fizicheskikh problem Akademii nauk SSSR
(Institute of Physical Problems of the Academy of Sciences,
USSR)

Card 2/3

81398

A High-current Microtron

S/056/60/012/004/017/048
B004/B070

SUBMITTED: June 15, 1960.

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Card 3/3

86911

S/056/60/039/005/028/051
B006/B077

6.9410

14.2500

AUTHOR:

Kapitsa, S. P.

TITLE:

Radiation From a Charge Moving in an Inhomogeneous Medium

PERIODICAL:

Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1960,
Vol. 39, No. 5(11), pp. 1367-1370

TEXT: The present work deals with a theoretical investigation of the intensity, polarization, and directivity of radiation emitted from a charge that moves uniformly in a medium with randomly distributed inhomogeneities. The resulting incoherent radiation can be considered as a type of transition radiation from the inhomogeneities. This effect is analogous to the light dispersion and can be thought of as a scattering of the waves which accompany the particle. Contrary to the Cherenkov effect the emission from inhomogeneities appears already at velocities which are smaller than the phase velocity of light in a medium. In the theoretical investigation of radiation the field produced by the motion of the charge is represented as the sum of plane waves; the excitation of the field is done by the distribution of the charge density and current

Card 1/4

86911

Radiation From a Charge Moving in an Inhomogeneous Medium

S/056/60/039/005/028/051
B006/B077

density $\rho = e\delta(\vec{r}-\vec{v}t)$ and $\vec{j} = e\vec{v}\delta(\vec{r}-\vec{v}t)$. The vector potential, the scalar potential, and the field $\vec{E}_{\vec{k}} = \frac{i\omega}{c} \frac{\vec{A}_{\vec{k}} - i\vec{k}\phi_{\vec{k}}}{k}$ are given in Fourier representation ($\omega = k\vec{v}$, \vec{k} -wave vector, \vec{v} velocity of the charge). The radiation from the inhomogeneities of the medium is dealt with from the viewpoint of the scattering theory. The radiation in the case of scalar scattering from random inhomogeneities of the dielectric constant ϵ is emitted from volumes which are small with respect to the wave length. This corresponds to the Rayleigh scattering by small particles or density fluctuations assuming the scatterers emit dipole radiation. The total intensity in the

interval $d\omega$ of the incoherent radiation is given by $dI_{\omega} = \frac{8\pi\omega^4\sqrt{\epsilon}}{3c^3} \int N |\vec{P}_{\omega}|^2 dV d\omega$,

N being the number of scattering centers per unit volume, \vec{P}_{ω} the Fourier component of the dipole moment of the scattering element having the

polarization α . As $\vec{P}_{\omega} = \alpha \vec{E}_{\omega}$, $dI_{\omega} = \frac{8\pi\omega^4\sqrt{\epsilon} N \alpha^2}{3c^3} \int |E_{\omega}|^2 dV d\omega$. The scattering

properties of the medium are well represented by the extinction coefficient

Card 2/4

86911

Radiation From a Charge Moving in an Inhomogeneous Medium

S056/60/039/005/028/051
B006/B077

$s = \frac{8\pi\omega^4}{3c^4} N_A^2 = \frac{\omega^4}{6\pi c^4} \sqrt{\epsilon^2}$, which has the dimensions of a length. An infinite plate of the thickness l (l coincides with the x -axis) is considered; the formulas for the radiation $J_\omega = dI_\omega/d\omega$ emitted by a unit length of the path of the moving charge, are given by: $J_{\omega x} = \frac{2\pi e^2 s}{c\beta^2 \epsilon^{3/2}} (1 - \epsilon\beta^2)$, $J_{\omega yz} = \frac{2\pi e^2 s}{c\beta^2 \epsilon^{3/2}} \left(\ln \frac{p_\omega^2 v^2}{\omega^2 (1 - \epsilon\beta^2)} - 1 \right)$, $\beta = v/c$, $p^2 = k_y^2 + k_z^2$, p_ω is the upper limit of integration with respect to dp . The behavior of the integrals if $\epsilon\beta^2 < 1$, that is, below the Cherenkov threshold is studied. $J_{\omega x}$ converges, but $J_{\omega yz}$ shows a logarithmic divergence at the upper limit, that is at small intervals. For the total spectral energy density emitted by a charge (per unit length of path) the following expression is obtained: $J = \frac{\pi e^2 s}{c\epsilon^{3/2} \beta^2} \left(2 \ln \frac{\omega_\omega}{\omega \sqrt{1 - \epsilon\beta^2}} - \epsilon\beta^2 \right)$. The ratio of the intensities which are emitted parallel and transverse to \vec{v} is given by $\frac{J_{\parallel}}{J_{\perp}}$

Card 3/4

86911

Radiation From a Charge Moving in an
Inhomogeneous Medium

S/056/60/039/005/028/051
B006/B077

$$= \frac{\ln [\omega_0 / \omega \sqrt{1 - \epsilon \beta^2}] - 1/2}{\ln [\omega_\infty / \omega \sqrt{1 - \epsilon \beta^2}] - \epsilon \beta^2 + 1/2}$$
 and that of the polarizations by $\frac{P_{||}}{P_{\perp}}$

$$= \frac{\ln [\omega_\infty / \omega \sqrt{1 - \epsilon \beta^2}] - 1/2}{1 - \epsilon \beta^2}$$
 ; $\omega_\infty = p_\infty / v$; the intensity ratio between this radiation and the Cherenkov radiation, given as the ratio of the quantum numbers, is found to be $n/n_{ch} \approx \alpha / \lambda^3$; $\lambda = 2\pi c / \omega \sqrt{\epsilon}$). The author thanks L. D. Landau and L. A. Vaynshteyn for discussions. There is 1 Soviet reference.

ASSOCIATION: Institut fizicheskikh problem Akademii nauk SSSR (Institute of Problems of Physics of the Academy of Sciences USSR)

SUBMITTED: June 15, 1960

Card 4/4

27888

S/030/61/000/010/004/011
B102/B104

21.3000

AUTHOR: Kapitsa, S. P., Candidate of Physics and Mathematics

TITLE: A new effective fast-neutron source

PERIODICAL: Akademiya nauk SSSR. Vestnik, ³¹no. 10, 1961, 65 - 69

TEXT: The cyclic microwave accelerator, the microtron of the Institut fizicheskikh problem im. S. I. Vavilova (Institute of Physical Problems imeni S. I. Vavilov) designed by S. P. Kapitsa, V. P. Bykov, and V. N. Melekhin (Zh. eksperiment. i teor. fiz., 1960, t. 39, str. 997; 1961, t. 41, str. 368), belongs to the largest accelerators of this type and was the first in the Soviet Union. It operates at a wavelength of 10 cm, the magnetic field is 1070 oersteds. The electromagnet, the poles of which constitute the walls of the vacuum chamber, weighs 1.5 tons. The microtron produces a pulsed beam of fast electrons (pulse duration 2 - 2.2 μ sec), in which the individual electron clusters have a length of 5 - 7 mm; the pulse duty factor is 1000. Since in this type of accelerator electrons moving at almost light velocity are accelerated, i. e., by about the rest energy (511 kev) for each circulation, the main

Card 1/3

27888

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B102/B104

A new effective fast-neutron source

difficulty of designing a microtron lies in developing an exact resonator with an output of several hundreds of kilowatts. It became evident that in order to reach higher amperages, the injection conditions would have to be improved, for which reason a new resonator type for the microtron was developed at the Institute of Physical Problems. It is of cylindrical shape (80 mm diameter, 20 mm height) and is excited over a waveguide with E_{010} oscillations, the electric field being oriented in the direction of the resonator axis. It consists of copper and is water-cooled. In its side wall there is the electron emitter, a lanthanum boride thermionic cathode (100 a/cm^2). The field in the resonator reaches 400 - 500 kv/cm and is traversed twelve times by the electrons, whereby they reach an energy of seven Mev at 25 ma. The electron orbits were calculated with high accuracy by the electromechanical trajectorograph developed at the Institute of Physical Problems by G. P. Prudkovskiy, an analog computer, and the digital computer "Strela". Experimental investigations of the electron clusters were conducted by V. P. Bykov. The fast-electron scanning could be carried out with a time resolution of $5 \cdot 10^{-12}$ sec. The

Card 2/3

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B102/B104

A new effective fast-neutron source

density of relativistic electrons in a cluster was of the order of magnitude of 10^8 cm^{-3} . The efficiency of the microtron (ratio beam power to shf power) was 12 - 15%. Estimations showed that a maximum of 50 - 100 Mev and currents of about 1 a may be reached with such a microtron. The Institute is planning a new design for 30 Mev. V. I. Veksler (Dokl. AN SSSR, M. 1944, t. 43, str. 346; t. 44, str. 393) is mentioned. There are 2 Soviet references.

Card 3/3